







Section 5

Water Infrastructure

INTRODUCTION

Water infrastructure for the Golden Valley South property is discussed herein. The section is organized as follows:

1. Water system infrastructure (including water supply and demand)
 - a. Project background
 - b. Water system assumptions
 - c. Source water
 - i. Groundwater
 - ii. Surface water
 - iii. Basic source of supply system requirements
 - d. Water quality and treatment
 - e. Water distribution and storage layout
 - f. Ownership of the water system alternatives
 - i. Formation and operation of a private water company
 - ii. Private Water company ownership transfer
 - iii. Extension and expansion of existing CC&N for Water Company.
2. Reclaimed Water System Infrastructure
 - a. Project background
 - b. Reclaimed water system assumptions
 - c. Reclaimed water demand
 - d. Reclaimed water classifications
 - e. Reclaimed water distribution and storage layout
 - f. Ground water recharge component

WATER SYSTEM INFRASTRUCTURE (including Water Supply and Demand)

Project Background

The project area is currently undeveloped in respect to a water system infrastructure, or organized development. There are several former and existing manufactured homes on, or adjacent to the project boundary served by individual private wells or deliveries by water trucks. Several miles to the north, the Valley Pioneers Water Company (VPWC) operates an 1,800 connection system. The VPWC's existing water system infrastructure in the area is inadequate to support a municipal type water supply system. However, there has been development of water resources in the area in order to support the operations of Valley Pioneers Water Company and Walnut Creek Water Company. A key aspect of the current water infrastructure includes a Designation of Adequate Water Supply for Valley Pioneers Water Company (VPWC) by the Arizona Department of Water Resources (ADWR). Although the designation is for a small demand of only 800-acre feet per year it is anticipated that hydrogeological studies can demonstrate significantly increased amounts of groundwater is available to the area based upon preliminary hydro-geologic studies performed by the State of Arizona and current studies being performed by Errol L. Montgomery & Associates (EMA) for Rhodes Homes.

There are currently 7 water wells registered with the Arizona Department of Water Resources (ADWR) within the immediate vicinity of the Golden Valley South Property (See attached Figure 5-1). Five of these wells were formerly utilized as water supply for a large mining area not in the area and the wells have been transferred to Valley Pioneers Water Company. These wells historically pumped approximately 7,000 acre-feet per year and the water was transported many miles to the north via pipeline. While all of these wells combined could likely provide sufficient water quantity for a master planned development it is anticipated that new high production wells will be installed on the Golden Valley South parcel, as the cost of rehabilitating the wells, and high pumping costs makes it more economical to drill within the parcel. Also, these wells are owned by VPWC, and full agreements to provide water to the parcel have not been reached. While there has been no historic need to drill and equip wells for the quantities required of a master planned community within the boundaries of the Golden Valley South project, a definitive conclusion as to groundwater quantity and quality adequate to support the planned project can still be made. EMA believes that regional data and data from the nearby Griffith Power plant well field and the VPWC wells formerly owned by Duvall indicate that it is feasible to develop the groundwater resources in the area in order to serve the project with a municipal type water supply. Rhodes Homes, via EMA, plans to submit an application for a Statement of Water Adequacy with the Arizona Department of Water Resources by early summer 2005. This application will be based upon the information gathered by the State in previous studies, and current well drilling operations being performed by EMA and Layne-Western Drilling.

Water System Assumptions

The following assumptions have been made to determine water system demands, treatment alternatives, and distribution system needs:

1. 33,000 dwelling units – within master planned area
2. Average water usage rate = 150 gpcd (0.17ac/ft/yr)
3. Average number of people per household = 2.4 (assumes an even mix of active adult - 1.8 and single-family residences – 3.0), Average number of dwelling units per acre = 6 for the entire project.
4. Peaking factors are 2.0 for max day and 3.5 for peak hour (Arizona American Water development standard).
5. Pressure zones are defined as having low pressure of 45 psi and high pressure of 95 psi – (UDACS for Clark County, NV). Approx. 110 feet.
6. Average well production rate is presumed at 1,200 gallons per minute.
7. Groundwater supply must meet max day demand with the largest producing well in a system out of service.
8. Distribution pumping is sized for peak demands with the largest pump out of service.
9. Storage capacity is sized for the higher of the following criteria (from City of Henderson, NV): 1) twice the difference of peak hour demand less maximum day demand for six hours OR 2) the difference of peak hour less maximum day demand for six hours plus three hours of fire flow. Fire flow is a minimum of 1500 gpm for residential, higher for commercial uses – assume 2500 gpm.
10. Parcels north of Shinarump are not included in the overall system.

Source Water

The source water for this development will be groundwater from the Sacramento Valley basin. A brief discussion of the options follows below.

Groundwater

The groundwater basin to the immediate west of Kingman and directly under the Golden Valley South project is known as the Sacramento Valley Basin. The overall availability of groundwater in the immediate vicinity of the project was evaluated by ADWR in 1993. ADWR reported that in the area from Ash Drive to Yucca Drive, immediately adjacent and south of the project, there is enough groundwater to satisfy 16,000 acre-feet per year of annual demand for 100 years before the water table lowers to 1200 feet below land surface. It is this water that can be utilized for the proposed project through the construction of wells and infrastructure for completion of a water system.

Based on the initial research summarized above and the current work being performed by EMA, it appears feasible that there are sufficient amounts of physical groundwater available to support the Golden Valley South project. However, it is Stanley

Consultants and EMA's recommendation to confirm the "regulatory availability of this resource" with ADWR and Mojave County officials. In addition, further hydrogeological studies will be completed to prove out the groundwater resource in detail. Drilling and testing operations are already underway and an application for Analysis of Adequate Water supply will be submitted to ADWR late spring, early summer 2005.

Surface Water Option

Kingman City owns approximately 18,500 acre feet of Colorado River water via the Central Arizona Project (CAP) allocation. Kingman City is currently selling its rights to the Mohave County Water Authority (*City of Kingman 2004-2005 Community Prospectus, page 19*) in an effort to raise capital for improvements to the City's existing system. This right, or other rights available from Indian tribes, may be available as a means to insure an alternative long-term water supply for the development.

It is noted here that using surface water for the development will likely be more costly than groundwater sources. The water must be transported to the site and treated via a complete water treatment plant, which includes a filtration system. For these reasons and in the absence of any identified surface water rights with a "place-of-use" near the project, ground water development appears to be the most feasible source of municipal supply. This determination is based on Stanley's understanding that the Mohave County area is not currently within an Arizona Active Management Area (AMA). Within Arizona AMAs, there is a requirement that a water system must meet the "safe yield" provisions of Arizona statute by 2025. This provision means that any water system within the AMA must prove that the water withdrawn from an aquifer is replaced by water from another source such that there is no net loss of water from the aquifer. If Arizona were to, at any time, declare the Mohave County area an AMA, then the development would have to meet the "Safe yield" provisions set up for the Mohave County AMA and surface water sources may be required to maintain the development's sustainability.

Basic source of supply system requirements

Table 5.1 provides a general overview of the water supply requirements of the system. Table 5.1 together with Figure 5-1 depict an overall groundwater supply system using wells to meet maximum day demand in each of the three proposed pressure zones and storage to meet the additional demands for fire flows and peak hour customer demand. Overall, the conceptual water supply system to meet the demands of the proposed 33,000 dwelling unit development is summarized as follows.

Demands: Average Day of 12.4 million gallons per day (14,000 Acre-Feet/Year)

Wells: 15 wells - average yield of 1200 gpm, plus standby wells for system reliability.

Storage: 3 storage sites with total capacity of 10 million gallons.

Pressure zones: 2570 (servicing Finished Floor elevations from 2355 to 2465)
2680 (servicing Finished Floor elevations from 2465 to 2575)
2790 (servicing Finished Floor elevations from 2575 to 2685)

Note: A refinement of these proposed zone split elevations is recommended once final phasing of the project is determined and an area-wide zone map (considering Valley Pioneers water system) is developed.

Note Also: Additional storage capacity could be built in order to reduce the number of wells required to be drilled and constructed with pumps. Preliminary cost estimates show that the most cost effective system still uses wells to meet maximum day demands. Also, the final water system operational design could involve various strategies using booster pumps, altitude valves, pressure reducing valves, and interconnections of the pressure zones for reliability and operational flexibility. The final design must consider water quality/chlorine residual concerns with stored water and operational reliability and energy efficiency.

A contemplated first Phase of Golden Valley South has been outlined as approximately the equivalent of 2000 dwelling units. Minimum water supply infrastructure for such a phase would be 2 wells and approximately 1 million gallons of water storage capacity.

The wells are expected to range from 1,200 to 2,000 feet in depth, have a 16" – 18" casing size, and range in horsepower from 250 to 500 hp. The wells are expected to be concentrated in the western ½ of the property. Stanley recommends that the developer perform well yield testing of the current well to determine aquifer characteristics; then, a more accurate determination of well yields can be obtained.

Water Quality and Treatment.

Historically, Groundwater in Arizona requires little if any conventional treatment to be defined as potable, or meeting the chemical constraint limits of the Safe Drinking Water Act (SDWA) amendments. In the Golden Valley area, all potable water is pumped from deep groundwater wells. The wells average more than 1000 feet in depth, with an approximate depth to groundwater of 700 feet. The Valley Pioneers Water Company is currently in compliance with current regulations of the SDWA. The water only requires a small amount of chlorine to provide water protection in the distribution system from microbiological contamination. A disinfection method for groundwater is now required under the newly promulgated groundwater rule.

Stanley has, as a part of this work effort, prepared a "Phase 1 environmental site assessment" of the area. There is insufficient public data for the immediate project area. However, some private wells, and those of the VPWC have found small amounts of arsenic. Also there are reports of recent detection of chromium in Kingman's

potable water wells in the proximity of the Kingman Airport. This report recommends testing of any proposed groundwater supplies for evidence of contamination by heavy metals and/or volatile organic compounds. The current well being drilled by EMA has encountered arsenic in trace amounts. Tests are also being conducted for radon and iron. Other wells in the Sacramento Basin have encountered high heat and high total dissolved solids (TDS) which can affect water quality and volume. The developer or water purveyor should anticipate the potential need to treat groundwater for one or more contaminants in order to comply with the Safe Drinking Water Act.

Kingman's Consumer Confidence Report for 2003 provided limited water quality data. These results are presented below. The data show no violations, but do show cause for concern with nitrates and chromium.

City of Kingman - Water Chemistry

Inorganic Contaminants							
Name	Units	MCL	MCLG	High	Range	Date	Major Sources
Nitrate	ppm	10	10	8.15	2.42-8.15	6/18/03	Leaching of septic tanks, sewage, fertilizers
Nitrite	ppm	1	1	<.01	<.01	6/18/03	Leaching of septic tanks, sewage, fertilizers
Chromium Blending Plan	ppb	100	100	60	3-60	6/18/03	Erosion of natural deposits

Distribution System Contaminants

Name	Units	MCL	MCLG	High	Range	Date	Major Sources
Trihalomethanes	Ppb	100	0	12	.7-12	3/10/03	By-product of drinking water chlorination

Treatment of surface water typically is achieved by conventional treatment methods (rapid mix with chemical addition, flocculation, sedimentation, filtration and disinfection) or, more recently, by the use of microfiltration systems that preclude the use of many conventional treatment elements. As groundwater is assumed to be the source of supply for the development, this topic will not be discussed in detail.

Water Distribution and Storage Layout.

The development of the water distribution system is based upon gravity flow for the pressure head. Whether the system is an extension of the VPWC system, or is developed for private or developer ownership, the location and number of tanks remains the same. Should the system be part of VPWC, the sizes of the tanks would be increased, and the associated costs be rebated by VPWC, and are therefore not included in this overview.

The volume produced by the wells will play an integral factor in the sizing of the tank system. The Duval wells, recently purchased by VPWC, are estimated at 1,500gpm. Other wells in the area show yields in the 600 to 1000 gpm range. This report use an average well yield of 1200 gpm as an approximation of what may be actually realized by the future drilling of new wells. It should be noted that a well is currently being drilled just north of Shinarump Road which will produce data to more accurately size the system, but had not been completed at the time of this report.

The Golden Valley South site has been divided into three pressure zones. The first tank is located well north of the project, on a promontory near Redwall Drive. This location provides the greatest flexibility for the development of all of Rhodes properties in the area, and makes it possible to service the second zone utilizing pressure reducing valves (PRV) until such time as a tank is warranted. Pipe sizing is based upon ultimate development demands at build-out and the maximum flow from all future wells serving the development.

Figure 5-1 shows a possible layout of the system, utilizing the three pressure zones. Table 5-1 provides a water demand, storage and well capacity scenario for the Golden Valley South Master Plan. Table 5-2 gives a preliminary cost estimate of the water system

Ownership of the Water System.

There are three primary ownership alternatives for the water system. They are as follows:

1. The developer works with Valley Pioneers Water Company (VPWC) and extends their service area to encompass the project.
2. The developer contracts with a private company or district to own and operate the water system.
3. The developer forms their own company to own the system with the option to contract for operations and maintenance.

Valley Pioneers Ownership. If the developer decides to ask the VPWC to extend their service area, the Water Company would assume responsibility for operation and maintenance of the water system. This basically means that the developer is shifting the liability of water system operation to VPWC. Given the current size of the VPWC system and operations, the developer will need to design and construct the infrastructure for VPWC acceptance without a payback mechanism. The system is then turned over to the VPWC for operation and maintenance. It is anticipated that a close working relationship can be established with VPWC and an application for an extension of the current Certificate of Convenience and Necessity (CC&N) can be filed concurrent hydro-geological studies are completed. Anticipated review and approval time by the ACC is approximately nine months to one year.

Private Company Ownership. The developer may decide to negotiate with a private water company to take ownership of the system. Liability of the system is removed from the developer, but there may be more flexibility and control available to the developer based on the deal that is negotiated. Typically, the developer negotiates with a private company to keep control of infrastructure construction to some point (as an example, all of Phase 1 for this project) so the developer can control the pace of development and better control costs. Infrastructure cost sharing is often a component of these deals (company would reimburse developer for capital expenditures the developer incurs and vice versa), so the developer may see some “time value of money” savings. Once construction of facilities is completed, ownership of the facilities can be turned over to the private company, at which point the liability for system performance also shifts to the private company. The developer would maintain liability for their constructed product. The private company will have to file a Certificate of Convenience and Necessity (CC&N) with the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process.

Arizona Statutes have a provision for special public water districts to be formed, which could be beneficial for the proposed project. Such a district would be a quasi-governmental agency and would require extensive legal and political effort to establish. Private ownership by a company or a district could take one and one half years or more to process fully through the State of Arizona.

Developer incorporates own water company. The developer may decide to form their own water utility company. This alternative involves the most paperwork and regulatory involvement (and leaves all of the liability for the system on the developer), but offers the developer the most flexibility in determining the course of action they can take. Once the company is formed, the developer can choose to negotiate system ownership or operations and maintenance agreements with private companies to find the best deal. They also can maintain total control over the system if they cannot strike a favorable deal with these entities. The developer will have to file a Certificate of Convenience and Necessity (CC&N) with the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process. Processing for a developer owned system typically takes twelve to twenty-four months through the State.

RECLAIMED WATER SYSTEM INFRASTRUCTURE

Project Background.

It is Stanley’s understanding that the Golden Valley 5800 will be developed with golf courses, open space and parks that will make the development a “destination development” in Kingman. As such, the use of reclaimed water to maintain these amenities is an attractive alternative. Using reclaimed water to maintain these

facilities reduces the amount of groundwater withdrawn from the local aquifer and provides a beneficial use for the wastewater generated from the development. The developer has expressed an interest in determining the feasibility of a reclaimed water system in this development.

Reclaimed Water System Assumptions.

The following assumptions have been made concerning the reclaimed water system.

1. The golf course will be developed in the first phase. This will compliment a 10 acre City park provided by the developer on a parcel north of the Golden Valley 5800.
2. The quantity of reclaimed water available for use will not be sufficient for reliable golf course and City Park watering until approximately 4,500 units are in service, so supplemental water sources must be used.
3. Reclaimed water system infrastructure required for build out purposes will be built in the first phase to avoid tearing up relatively new roads 2-3 years into the development.
4. Effluent is assumed to be Class A+.

Reclaimed Water Demand.

Popular uses of reclaimed water in destination developments include golf course watering and parkland green space watering. To maintain better control of the irrigation water supply, these facilities often construct lakes or other on-site storage facilities and the reclaimed water is supplied to these storage facilities. The land planning of the Golden Valley 5800 parcels is not to the stage of defining the quantity of green space that can be irrigated with reclaimed water, so an exact quantity of reclaimed water usage cannot be predicted at this time.

We can, however, gain an understanding of potential usage by looking at typical use rates of green space facilities. It is assumed (subject to verification with local climate and horticulture practices) that common green space areas - parks, roadway medians and golf courses – will be planted with Bermuda grass for summer growth and over seeded with Rye grass for winter growth. Using the conversion that 1 acre-foot of water equals approximately 325,000 gallons and using typical use rates of 4.0 to 5.0 feet per year for Bermuda and 1.0-1.5 feet per year for Rye grass, we can estimate that green space in the Golden Valley 5800 parcels will consume reclaimed water at an annual average rate of 5 to 6.5 acre-feet per year per acre, or in the range of 1.6 to 2.2 million gallons per year per acre of green space. Based on a typical 18-hole golf course using approximately 90 acres of turf, approximately 500 acre-feet per year of reclaimed water would be consumed. However, to avoid unreasonable costs for seasonal storage of reclaimed water, the reclaimed water system and golf course support plan would be analyzed using summer consumption rates for irrigation water.

Reclaimed water use peaks dramatically in the summer. Data from a metro Phoenix golf course provided by a confidential client indicates an average daily reclaimed water use between 800,000 and 1,000,000 gallons per day. In general terms, summer irrigation use in Kingman is projected to be similar to Phoenix metro use rates. If we maintain that it takes approximately 9,000 to 13,000 gallons per day per acre of green space to maintain Bermuda grass in the summer in Arizona, it can be concluded that at build out projections of 8,700,000 gallons of reclaimed water available per day the development can sustain between 600 and 850 acres of green space on reclaimed water. Preliminary estimates of green space are for less than 600 acres, so the development will have excess effluent that has to be disposed.

These demands will drop significantly in the winter, so an alternative method of disposal of reclaimed water is required. This is discussed in the wastewater section of this report.

Reclaimed Water Classifications.

Title 18, Chapter 11, Article 3 of the Arizona Administrative Code is attached. This document defines the various levels of reclaimed water in Arizona. In summary, the classes are A+, A, B+, B and C. Class A+ provides the developer with the greatest flexibility in reuse options. This report assumes that Class A+ effluent is desired by the developer (See Waste Water Section of this report)

Reclaimed Water Distribution and Storage Layout.

The reclaimed water system will require pumping from the wastewater treatment plant (WWTP) to the points of use. A storage reservoir would be required at the WWTP, with pumps provided for first phase use (pumping from approximate elevation of 2400 to 2550). As future phase reclaimed water needs develop, storage tanks and pumps will be constructed at optimized locations or, if golf course lakes are available, inline pump stations may be used to move water directly to the lakes. Piping from the WWTP would be sized for build out use; whether this is one large pipe or two smaller pipes of equal volume would be decided during detailed design.

For golf course irrigation using reclaimed water, a commonly used strategy is to pump the reclaimed water to golf course lakes, then pump out of the lakes for irrigation. While this means the water gets pumped twice, the course gains two inherent advantages from having the lakes filled with reclaimed water: (1) they are not replacing evaporated water with groundwater, thus saving the groundwater resource, and (2) the course has an irrigation buffer in case of temporary disruption to the reclaimed water distribution system.

Water and Re-Use Infrastructure System Costs

The following Table 5-2 indicates an “order of magnitude” or “probable construction cost” cost estimate for water and wastewater infrastructure facilities. These estimates are based on the preliminary conceptual plans as shown on Figures 5-1 through 5-2. They include basic capital costs for completing the basic infrastructure for the system. The estimates exclude any costs for water distribution within individual sub-divisions or “villages”. The estimates are intended to be used to evaluate the feasibility of the overall project. Subsequent master planning, conceptual and final design engineering services are required in order to obtain a reasonable level of precision for cost estimates for detailed planning or budgeting purposes.

Water Supply:

The basic scenario of the water system is to use gravity where-ever possible. Tanks will be placed on high ground, north of the development. Although this will require some “double piping” north of Shinarump, the system will not be directly tied to the VPWC system, at least initially. Wells will be located as close to the tanks as possible. Zoning of the system is based upon the typical 110-ft fall to give constant static pressures.

Reclaimed Water:

The overall plan for water and wastewater management includes reclaiming wastewater effluent and putting it to beneficial use for irrigation of golf courses and other large landscaped areas. For feasibility purposes only, these cost estimates are based on using only two (2) effluent pump stations (somewhat limiting the availability of effluent to the eastern most parcels) and pipelines sized for a peak day flow of approximately 8 mgd (24 inch reducing to 16 inch).

Table 5-1 - Golden Valley South - 5800 Acres - Projected Water Demands

Pressure Zone	Section	Township	Range	Land Use	Acres	Water Demand					
						Use Rate	per/DU	DU/a cre	use, gpd	use, max day	use, peak hr.
2570	8, 16	20N	18W	Res. & Comm.	640	150	2.4	6	1,382,400	2,764,800	4,838,400
2680	3,4,9,8,10,14,16 & 34(T21N)	20N	18W	Res. & Comm.	3200	150	2.4	6	6,912,000	13,824,000	24,192,000
2790	2, 3, 10, 11, 14	20N	18W	Res. & Comm.	1910	150	2.4	6	4,125,600	8,251,200	14,439,600
				TOTALS:	5750				12,420,000	24,840,000	43,470,000

Storage Requirements

Reservoir Volume Based on the Larger of the Following Criteria:

1. $V = 2 * (\text{Peak Hour Demand} - \text{Max Day Demand}) * 6 \text{ Hours}$
2. $V = (\text{Peak Hour Demand} - \text{Max Day Demand}) * 6 \text{ Hours} + \text{Fire Flow} * 3 \text{ Hours}$

Volume Required (Million Gallons)

	<u>Zone: 2570</u>	<u>2680</u>	<u>2790</u>	<u>Total:</u>
Equation #1	1.04	5.18	3.09	9.32
Equation #2	0.97	3.04	2.00	

Well and Pumping Requirements (Based on meeting Maximum Day Demands)

	<u>Zone: 2570</u>	<u>2680</u>	<u>2790</u>	<u>Total:</u>
Million Gallons per Day	2.76	13.82	8.25	24.84
Gallons per Minute	1,920	9,600	5,730	17,250
Wells @ 1200gpm (without standby wells)	2	8	5	15

Table 5-2 Rhodes Homes: Golden Valley South Preliminary Cost Estimate –Water Backbone

	Description	Quantity	Unit	Unit Price	Total
Water					
	Source/Supply	15@1200gpm	well w/pump	\$ 800,000	\$ 12,000,000
	Storage & Pumping	3 sites min. (10mgal)	EA	\$ 5,000,000	\$ 15,000,000
	Transmission Mains				
	30"	28,000	LF	\$ 142	\$ 3,976,000
	24"	45,000	LF	\$ 107	\$ 4,815,000
	18"	60,000	LF	\$ 93	\$ 5,580,000
				Total:	\$ 41,371,000
	Description	Quantity	Unit	Unit Price	Total
Reclaimed Water					
	Pump Station	1	5000 GPM	\$ 2,500,000	\$ 2,500,000
	Pump Station	1	3000 GPM	\$ 1,500,000	\$ 1,500,000
	Force Mains				
	24"	35,000	LF	\$ 110	\$ 3,850,000
	18"	15,000	LF	\$ 95	\$ 1,425,000
	16"	8,000	LF	\$ 85	\$ 680,000
				Total	\$ 9,955,000
Notes: Storage, mixing and water quality systems will be on Golf Course.					
Preliminary probable Water/Re-Claimed cost range is: \$45 to \$60 million.					